

Advanced TCCS for Spacesuit Applications, Phase I

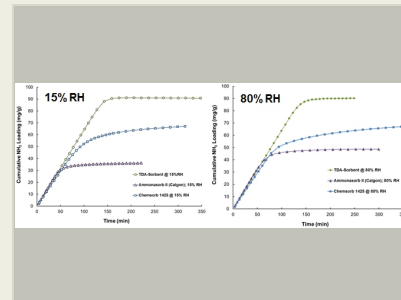
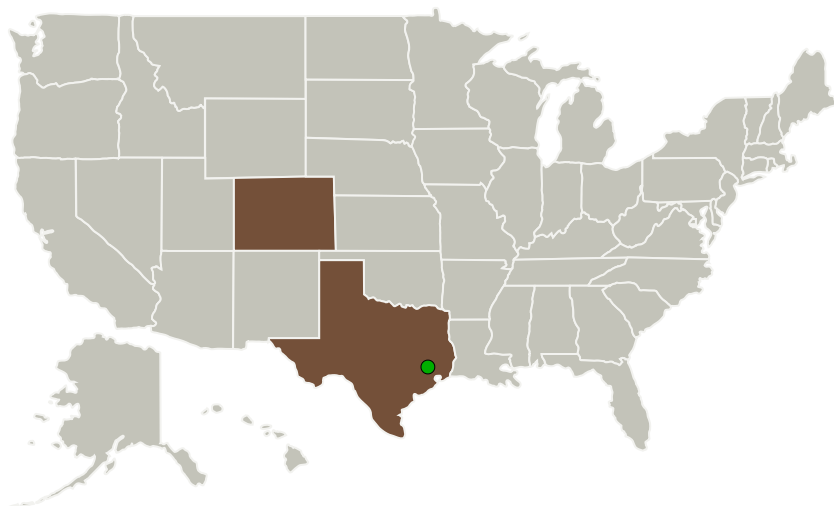
Completed Technology Project (2016 - 2016)



Project Introduction

A recent trade study showed that active removal of ammonia (NH_3) and formaldehyde (CH_2O) is critical to meeting the 24-hr SMAC limits in the advanced space suit designs (Jennings 2009). TDA Research, Inc. (TDA) proposes to develop a new TCCS for the PLSS based on a combination of a regenerable NH_3 sorbent and an ambient temperature catalyst that can oxidize formaldehyde into much more benign CO_2 to control the concentration of these contaminants in the spacesuit ventilation loop. In Phase I, with the guidance of molecular modeling, we will synthesize several sorbents and evaluate their potential in reversible NH_3 removal under representative conditions. We will also evaluate the efficacy of the ambient temperature oxidation catalyst for formaldehyde removal as well as for oxidation of other VOCs. We will demonstrate the regenerable sorbent's operation for a minimum of 5,000 adsorption/regeneration cycles and its catalytic activity for a minimum of 400 hrs (equivalent of 50 8hr EVAs). We will evaluate the impact of bed geometry and potential of using different integration options to the PLSS to ensure that the addition of these new materials will not impact the operation of the swing bed that removes carbon dioxide. We will carry out detailed design of the TCCS and determine its weight/volume to assess the logistics savings against the one-time use $\text{NH}_3/\text{CH}_2\text{O}$ removal sorbents.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
TDA Research, Inc.	Lead Organization	Industry	Wheat Ridge, Colorado
● Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations

Colorado	Texas
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Project Transitions

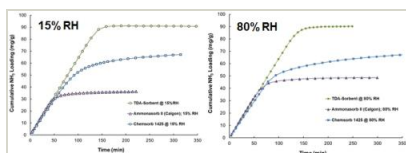
▶ **June 2016:** Project Start

✓ **December 2016:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140415>)

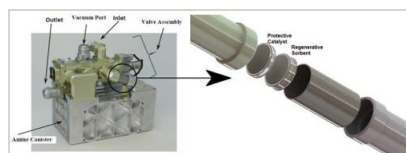
Images



Briefing Chart Image

Advanced TCCS for Spacesuit Applications, Phase I

(<https://techport.nasa.gov/image/126364>)



Final Summary Chart Image

Advanced TCCS for Spacesuit Applications, Phase I Project Image

(<https://techport.nasa.gov/image/135191>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

TDA Research, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

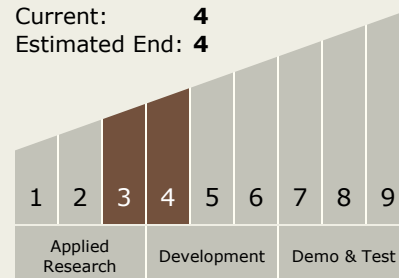
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Technology Maturity (TRL)

Start: 3

Current: 4

Estimated End: 4



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Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
 - └ TX06.2 Extravehicular Activity Systems
 - └ TX06.2.2 Portable Life Support System

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System